PBL as 'two steps behind cutting edge'

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It's important to understand PBL as an umbrella term.

In *Setting the Standard for Project-Based Learning*, the authors note that "often the distinction between *problem based learning* and *project based learning* is academic and possibly arbitrary," based on actual observed classroom practice. I agree in principle, but like Project-based Learning because it phrases things in terms of the student goal.

PBL has major benefits for student learning: a meta-analysis from 2023 found that PBL has moderate-to-large positive effects on student learning outcomes compared to traditional teaching methods. The same was true of students' thinking skills, including higher-order thinking skills like problem-solving skills and integrated application skills (yes, that's a bit of a 'water is wet' finding, but it's important to establish that baseline). The same meta-analysis found that a period of 9-18 weeks had the largest impact of student learning–that's why VIS uses semesters, which are usually between 16 and 18 weeks, to structure its Interdisciplinary PBL courses.

PBL actually improves test scores: a large-scale study of a PBL curriculum showed that students who took the PBL curriculum performed better on the associated Advanced Placement tests than students who took a traditional AP curriculum. This shows us that student learning which occurs in 'authentic' contexts can be transferred to more traditionally-legible contexts; IOW we don't have to sacrifice traditional markers of academic achievement for a new style of teaching. Another large-scale study showed improvement in elementary school students' science performance, showing that this effect is actually fairly generalized across different age levels.

PBL offers benefits over traditional instruction: a large meta-analysis (over 12,000 students between 1998-2017 in the included studies) had a large effect size (d_+=0.71). We use these meta-analyses to see what works across different contexts, and so it's clear that PBL is one of those things. Interestingly, the stage of education didn't significantly change the impact on the effect size. Effect sizes do change based on a few factors, though: Western students see a larger difference than East Asian students (though this is actually contradicted by a 2023 meta-analysis, which finds the opposite)–this raises questions for international schools that we should be reflective about. Social sciences also saw a greater effect than natural sciences–this may have to do with the epistemologies of those subjects but I'm not sure; however, an American meta-analysis found that in science courses studied, there was still an 86% increase in student learning compared with traditional methods (that number seems crazy high, but directionally correct).

PBL has some research to support improved student motivation: there's some research (like this study) but no big meta-analysis. However, I can say that our own school collects a lot

of student feedback data, and in aggregate student responses pretty strongly indicate that they're engaged by projects as a learning structure.

There are real limitations of this research, though: one meta-analysis from 2016 found that most studies didn't do random allocation of participants, so if we really wanted an ironclad causal link between PBL and improved student outcomes, we'd have to run RCTs to find that.

Student-Centered

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'Student Centered' learning is an incomplete framework. We don't want to think of the student as an individual, floating in negative space, whose interests are completely inherent to the individual.

Knowledge is a socially constructed phenomenon. One of the roles of school, therefore, is to habituate students to construct knowledge in collaboration with others, and apply that knowledge to solve real-world, socially-situated problems.

- **Example 1:** Students in my English class wrote a book that imagines Taiwan 5 years in the future, after a green transition. This involved interviewing and consulting with a dozen different experts. They chose smaller areas within this framework that interested them individually, but there was no ignoring the larger social problem of climate change.
- **Example 2:** One of the G12 capstone projects I'm supervising is about Taiwan's 'political jetlag' which is a term for politics that are relatively isolated from the outside world. The way the student is solving this is interviewing local politicians, NGO leaders, community organizers, etc, and asking them how their work connects with different UN Sustainable Development Goals. While the student is individually interested in politics and international relations, she's also using a framework that was decided on before she was even in high school.

This doesn't mean a lack of care for the student. Rather, it means that we as school designers have to think about students as a part of an ecosystem. The academic Sioux McKenna writes that *"It is not only motivation and cognitive ability that the student brings to the university. She also comes with norms and values and practices from school and home and then has to confront the often-alienating norms, values and practices of the university*."

Kyle's Questions

Describe your journey to PBL and Student-Centered Learning in under 3 minutes.

- I got into teaching because it's essentially a field where research on what actually works in the field is all quite new. We had 100 years of theorizing and ideology, but it's only in the last thirty or so years that researchers have made the empirical turn, so I've always thought of myself as coming into the field at an exciting time. And one of the things we know, from this new generation of empirical research, is that PBL works better than most other forms of teaching.

What does 'student-centered' mean to you?

- I'm actually not a huge fan of calling something 'student-centered.' It treats the student very much as an individual, when the whole point of education is to empower students to participate in and improve society–that's a social phenomenon. I'm much more a fan of thinking in terms of the ikigai framework, which we use in our Life Design class at VIS. That's finding the overlap between what the student loves, what the student is good at, what the student can (eventually) get paid for, and what the world needs. That framework brings the social element back in, in a way that an individual focus on the student doesn't necessarily emphasize.

Lots of people think of project-based learning as lacking 'rigour.' What would you tell those people, and how do you ensure there's the necessary 'meat?'

- PBL can absolutely lack rigor, just like any pedagogy. That depends a lot on the specific enabling or inhibiting factors in a particular program or campus. However, in general [discussion of research and meta-analyses].
- At the secondary level, authenticity provides a lot of the rigor for students. For example, one of the geography classes at VIS this semester has students mapping microplastic pollution in a local river; that required them to learn how to use GIS (Geographic Information Systems), a few different types of mapping technology, and some computer coding to pull real-time data from the Taiwanese EPA's monitors. That pulls in standards not just from the Grade 11 course that these students are in, but from the *next* course in the sequence, so that students are working above and beyond the demands of the curriculum. That's a result of following a project down its own path, not just trying to treat curricular standards as a set of checkboxes.
- Also worth noting that we see the PBL difference in traditional forms of assessment as well, so it's not just retrofitting learning goals to a chaotic process. [talk about AP study & elementary science study in Tab 1]

Mandated Curriculum? Hindrance or Help for PBL?

- Depends on the curriculum. The best process we've found at VIS involves working with standards that speak to particular competencies or skills, and then designing projects around different ways to demonstrate those skills. In that way, it's very similar to traditional backwards design (and I don't think it's a mistake that the research on PBL and the Understanding by Design framework developed over the same period).
- For project design, it's often a good idea to have a framework, especially for teachers who are newer to the process. PBLWorks obviously has a strong set of design elements

you can use to generate repeatable projects; Knowles Initiative has a good project planning process you can use. The Institute for Humane Education has a fun 'solutionary' framework you can use to plan projects. [include links in show notes]

Are there some curriculums that work better for PBL than others? Do you design your own?

- Different curricula really have their own approaches, but we're seeing more and more of a global convergence on standards as a series of 'can do' statements, and that's been a big benefit for curricula. It means that schools get more freedom to pull from different curricula to hit different targets, and that creates the flexibility for PBL.
- At VIS, we use a homegrown curriculum adapted from the provincial standards used in Ontario, Canada. That's created a good balance of international legibility vs. local responsiveness. So much of curriculum design is a negotiated process, though, and so having a coherent set of practices around that is more important than a strictly written curriculum that fulfills absolute and unchanging standards.

How do you offer students choice in PBL with mandated standards and skills to cover?

- Like with all curriculum, it's about negotiation and pitching. At VIS, students start with a period of 'traditional' instruction that covers key skills & processes, and then they go through an iterative process of pitching, refining, and pitching again to develop a product that will show their mastery of those skills. For example, in our Advanced Functions classes, students were studying sinusoidal functions, and to show that they understood the different amplitudes, periods, etc, of those functions, they analyzed a series of blood spatters from a 'crime scene.' They could have done the same with a Jackson Pollack painting, but they watch a lot of true crime, so the situation came from their interests.

Where's the starting point for project design? Are learners involved in the process?

- Learners get increasingly involved in the process as they go through the school. In the early grades, they have mandated classes, and those projects are fairly locked down so that students get practice in the soft skills they need to eventually manage their own projects. For example, our Grade 9 science class has students designing an 'ecohouse' under fairly strict circumstances, but by the time students get to the Grade 11 Biology class, they're designing a Mars habitat with basically only the natural limitations that actually exist (though those are still substantial, given that it's, you know, Mars). This ends in the Grade 12 capstone project, which is entirely student-designed, down to pulling different curricular strands from the Ontario curriculum, and explaining in their project proposal how their project will show they've met those standards.

Take us behind the scenes of your favorite project. What did students do and how did the curriculum support them?

- Obligated to mention my students' book!
    - Download the ebook here (EPUB link).
    - Download the ebook here (PDF link).

- Since I deal with curriculum, I have to give a shout-out to my favorite projects across all the different grades and classes at the school.
    - Grade 9:
        - the Science class is completing phenological observations at a major park & memorial over 2 months every semester and analyzing them for population changes over the years
        - Students working with different NGOs to create merch to sell & donate the profits to the NGO
    - Grade 10:
        - students give a tour of local historical sites each semester
        - Students developing an organic mold killer, since they noticed that existing mold killer tend to contain all sorts of harmful chemicals
        - Students developing videogames to explore the literatures and cultures of different societies around the world
    - Grade 11:
        - sinusoidal analysis project
        - Students building a flight management game where you have to balance profits, costs, and emissions for an airliner over your run
        - The danshui mapping project
        - The turbonanas project
        - The ReCity project
    - Grade 12:
        - Zoe's PBL+ project, Joann's PBL capstone, Jasmijn's PBL capstone, Mandy's PBL capstone